The Energy Consumption and Pollutants Emissions of the Energy Intensive Industries in Beijing-Tianjin-Hebei Region of China

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Abstract

This works studied the energy consumption and pollutants emissions of energy intensive industries in Beijing-Tianjin-Hebei Region of China from 2005 and 2011. The overall stutus of the GDP growth, industrial added value, energy consumption and pollutants emissions of the energy intensive industries were firstly researched, and then this indexes were studied for each province. The results showed that the energy consumption and pollutants emissions of the energy intensive industries are so unbalanced distributed in the three provinces that the acchievements the city of Beijing made by removing energy intensive industries for saving energy and reducing emissions had been covered by the increasing development of energy intensive industries in the city of Tianjin and Hebei province, they should cooperate for each other to get better air quality.

Keywords

Energy Intensive Industries; Energy Consumption; Pollutants Emissions; Beijing-Tianjin-Hebei

Introduction

Energy intensive industries, which consume a lot of energy and emit plenty tons of pollutants each year, had made great contributions to the economic development in Beijing-Tianjing-Hebei region of China. However, the mindless development of the energy intensive industries has also greatly damaged the environment of this region (Liu[1]). A typical example is that since the beginning of year 2013, several large scale fog and haze had appeared in Beijing-Tianjing-Hebei region, which demonstrates that this region has become one of the most polluted areas in the world and how to make the air being more clearer becomes the most urgent work in near future.

Actually, the environmental problems had plagued this region for many years, especially its center, Beijing, the capital of China. Since 1998, the Beijing government had realized the importance of environmental protection since the air pollution has generated many social problems (Zhang [2]; Wang [3]]. Many factors resulted in the severe air pollution of this city[Hao [4]; Chen [5]; Wang [6]] and the government had took many measures to control it [Duan [7]; Li [8]; Wang [9]]. Many reAnd the most noticeable way is to move its energy intensive industries from the center of Beijing to the urban areas or even farther places like Tianjin and Hebei province. During this period, more than 200 energy intensive companies had been moved from the center, including Capital Iron & Steel Factory, Beijing Coking Plant, Beijing Chemical Plant and so on.

Combining by other measures, the environment in Beijing had been improved greatly, the number of "Blue Sky" increased every year, and people living in this city got more and more satisfied with their clearer air. However, all the achivements in environment protection of Beijing become unobvious on the condition that large scale fog and haze happens so frequently.

Actually, the environment protection of Beijing is not only the business of Beijing, but also the business of its

surrounding areas like Tianjing and Hebei provinces since the atmosphere of these areas is connected and can not be geographically divided. Unfortunately, the environmental protection in Tianjin and Hebei province was not attached so much importance as in the city of Beijing. As a result of this unbalanced environmental controlling, although lots of energy intensive enterprises had removed or disappeared in Beijing, even more mushroomed in Tianjin and Hebei province, and this brought much more damage for the air across this region.

This work analyzes the development of energy intensive industries across Beijing-Tianjing-Hebei region, and also its energy consumption and emission pollutants during last few years. By analyzing them we want to find the relationship between the air pollution and the energy intensive industries inside and outside the city of Beijing. The rest of this work is organized as follows: Part 2 describes the data used in the analysis, Part 3 analyzes the currents overall status, Part 4 presents the provincial difference and Part 5 presents the sectoral difference. The final part concludes this work.

Data Description

Scope of Energy Intensive Industries

According to the "2010 National Economic and Social Development Statistics Bulletin of China"(NBSC [10]), six industries are considered as the energy intensive industries, which are Processing of Petroleum, Coking, Processing of Nuclear Fuel (PPCPNF), Manufacture of Raw Chemical Materials and Chemical Products (MRCMCP), Manufacture of Non-metallic Mineral Products (MNMP), Smelting and Pressing of Ferrous Metals (SPFM), Smelting and Pressing of Non-ferrous Metals (SPNM), Production and Supply of Electric Power and Heat Power (PSEPHP).

Data Collection and Processing

Most of the data used in this work is collected from the Statistical Yearbook and the Bureau of Statistics official website in Beijing, Hebei and Tianjin province.

Since the earliest year that we can find when the government publish its sectoral energy consumption data is 2005, so this is the start year of this research and the end year is 2011.

The data of sectoral GDP which is used for reflecting the sectoral economic development and calculating the energy intensity of GDP for energy intensive industries, can not be directly copied from the Statistical Yearbooks or the Bureau of Statistics official websites since only the sectoral gross industrial production value was counted from 2008, while the sectoral industrial added value was not published since that time. The sectoral industrial added value of Beijing and Hebei province in 2009 is calculated by the sectoral industrial added value in 2008 multiplying its cumulative growth rate in December 2009, and the same calculating method for 2010 and 2011. While for Tianjin province, there is no place for us to find the data on the sectoral cumulative growth rates of the industrial added value, so we replace them by the gross industrial added value growth rate for calculation.

The sectoral energy consumption data is collected from the provincial Statistical Yearbooks, and the mainly sectoral air pollutants emission is calculated by multiplying its energy consumption and pollutants emission coefficient shown in Tab. 1 (ECNJS [11]).

TABLE 1 INDUSTRIAL MAIN AIR POLLUTANT EMISSION COEFFICIENTS

Kinds of industry	Kinds of air pollutant	Pollutants emission coefficient (t/tce)
Non electric power industry	SO_2	0.0165
	NO_x	0.0156
	Dust	0.0096
Electric power industry	SO_2	0.0200
	NO_x	0.01725
	Dust	0.008375

The Current Overall Status

By the end of 2011, the total GDP of Beijing-Tianjing-Hebei region researched 5142.319 billion RMB, in which the city of Beijing, Tianjin and Hebei province generated 1600.04, 1119.099 and 2422.82 billion RMB, increasing by 8.1%, 16.5% and 11.3% than 2010 respectively. Among these values, the energy intensive industries totally contributed 923.690 billion RMB, accounting for 17.96% of the total GDP in this region. The industrial added values of energy-intensive industries in the city of Beijing accounted for 4.81% of its overall GDP, and the city of Tianjing accounted for 13.50% and the Hebei province accounted for 46.44% , which are obviously different across the region.

The total energy consumption of Beijing-Tianjing-Hebei region is 435.15 million tons, in which the city of Beijing, Tianjin and Hebei province was 66.71, 73.46, 294.98 million tons respectively. The total industrial energy consumption was 253.17, in which the city of

Beijing, Tianjin and Hebei province was 20.58, 51.66, 180.93 million tons respectively. The total energy consumption of energy intensive industries is estimated as 205.60 million tons, increasing 37.28% than the level of 2005, accounting for 47.25% of the whole social consumption and 81.21% of the whole industrial consumption. Except the PPCPNF industry, the energy consumption growth of the other industry increased during 2005 and 2011. The SPFM consumed the highest energy, whose growth is 56.16%, followed by the PSEPHP industry, and the SPNM consumed the least (FIG.1).

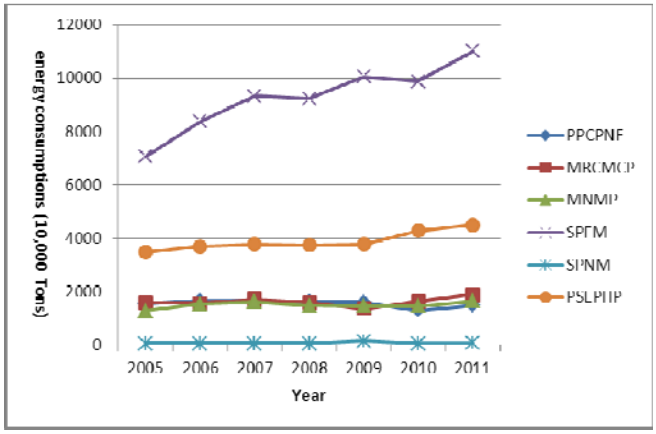

FIG.1 THE ENERGY CONSUMPTION OF THE ENERGY INTENSIVE INDUSTRIES IN BEIJING-TIANJIN-HEBEI REGION

According to the pollutant emission coefficients shown in Tab.1, it can be easily calculated eijing-Tianjing-Hebei region had totally emitted SO_2 by 7.33 million tons, NOx by 6.86 million tons and dust by 4.12 million tons. Among them, the energy intensive industries had totally emitted SO_2 by 3.55 million tons, NOx by 3.28 million tons and dust by 1.92 million tons, increasing by 36.89%, 37.08% and 37.54% than the level of 2005, accounting for 48.43%, 47.81% and 46.60% of the whole social emissions respectively.

It can be easily seen that the GDP contribution of the energy intensive industries was less than its contribution to the energy consumption and air pollution in Beijing-Tianjin-Hebei region.

Provincial Analysis

The City of Beijing

1) Energy Consumption

It can be easily seen from FIG.2 that the total energy consumption of the energy intensive industries in Beijing presented a downward trend during the period of 2005 and 2011, which had reduced by 28.51%. This was mainly contributed by the decrese in energy consumption of SPFM industry with a decresing rate of 95.99%. Except the SPNM and PSEPHP industries, the energy consumption of most of the other industries decreased during this period.

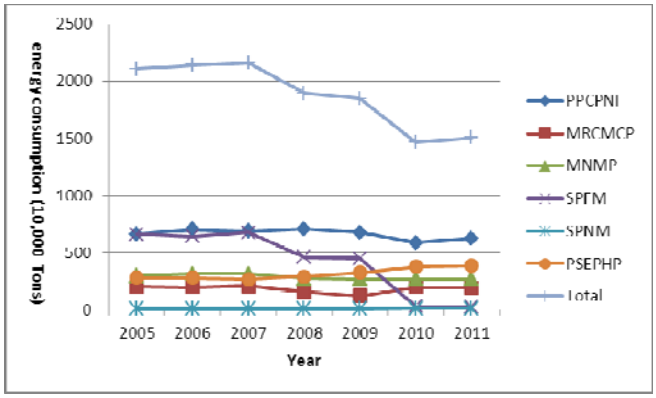

FIG.2 THE ENERGY CONSUMPTION OF ENERGY INTENSIVE INDUSTRIES IN THE CITY OF BEIJING

2) Pollutants Emission

The SO_2 emissions, NOx emissions and dust emissions in the city of Beijing had decreased from 357, 330.6, 333,227.1 and 198,834 tons in 2005 to 261, 943.8, 241,274.6 and 139,859.5 tons in 2011, by 26.69%, 27.59% and 29.66% respectively. The overall decrease is mainly contributed by the SPFM industry, most of the other industries also showed downward trends, except the PSEPHP industry, whose pollutants emissions had increased by 38.34% in 2011 than the level of 2005. It can be clearly seen from FIG.3-FIG.5 the most pollutant energy intensive industry in the city of Beijing was PPCPNF and SPFM industry in 2005, but at the end of 2011, the most pollutant industry was PPCPNF industry, that because a lot of companies in PPCPNF industry had been removed from the city.

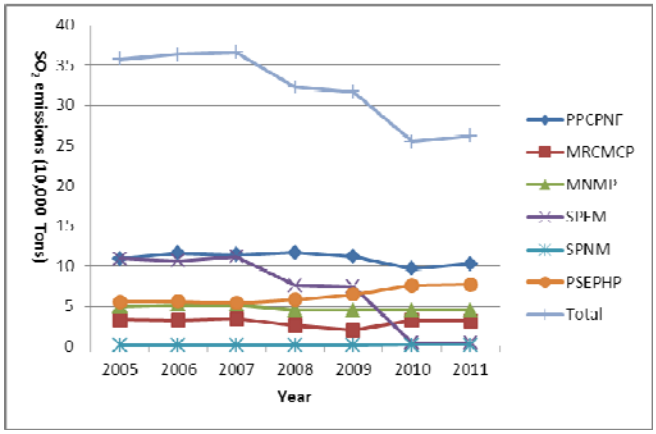

FIG.3 THE SO_2 EMISSIONS OF ENERGY INTENSIVE INDUSTRIES IN THE CITY OF BEIJING

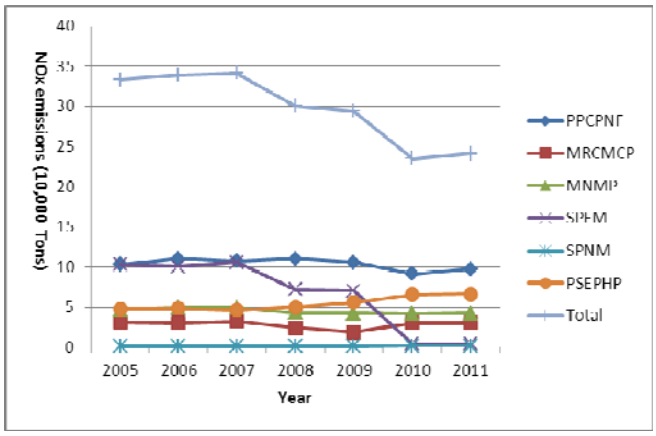

FIG.4 THE NQx EMISSIONS OF ENERGY INTENSIVE INDUSTRIES IN THE CITY OF BEIJING

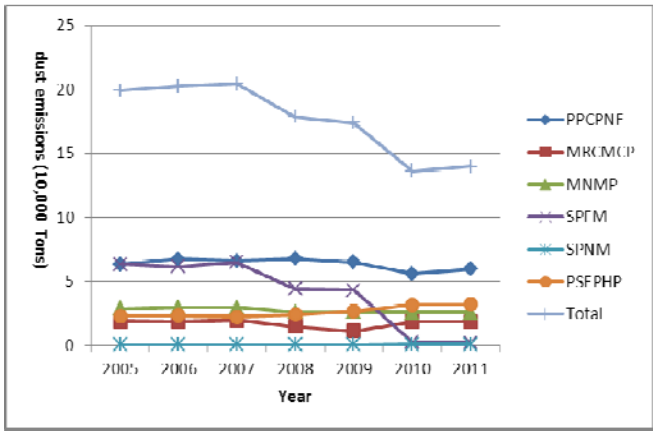

FIG.5 THE DUST EMISSIONS OF ENERGY INTENSIVE INDUSTRIES IN THE CITY OF BEIJING

The city of Tianjin

1) Energy Consumption

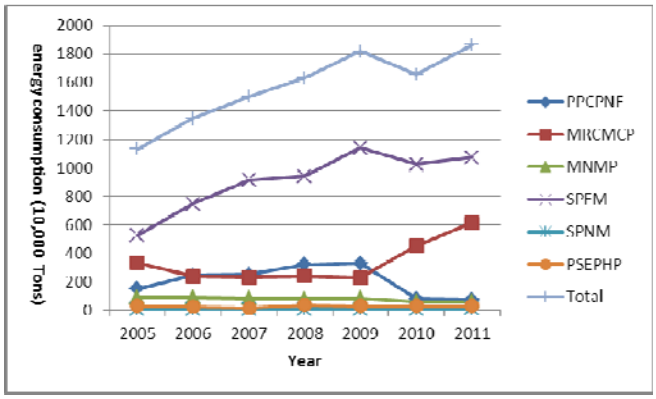

FIG.6 THE ENERGY CONSUMPTION OF ENERGY INTENSIVE INDUSTRIES IN THE CITY OF TIANJIN

Unlike the city of Beijing, the energy consumption of the energy intensive industries in the city of Tianjin had increased from 11.3205 million tons of tce in 2005 to 18.6168 million tons of tce in 2011, increasing by 64.45%. That was mainly contributed by the increase in energy consumption of MRCMCP and SPFM industry (FIG.6), which had increased by 85.44% and 101.08% during this period. The energy consumption of other energy intensive industries showed downward trends.

2) Pollutants Emission

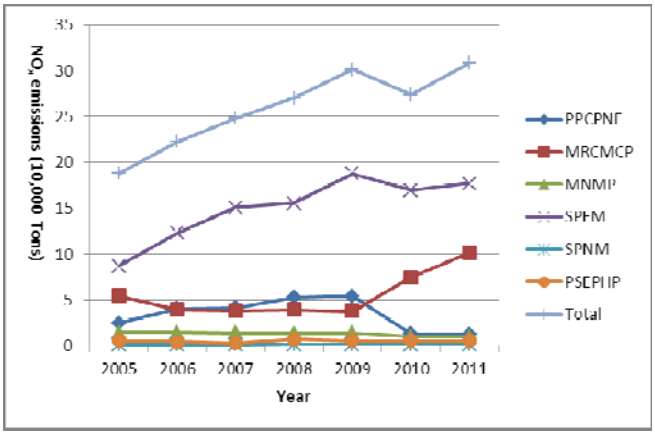

FIG.7 THE SO_2 EMISSIONS OF ENERGY INTENSIVE INDUSTRIES IN THE CITY OF TIANJIN

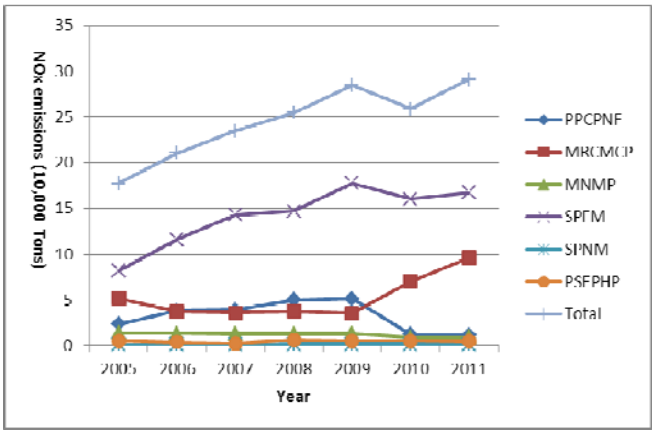

FIG.8 THE NQx EMISSIONS OF ENERGY INTENSIVE INDUSTRIES IN THE CITY OF TIANJIN

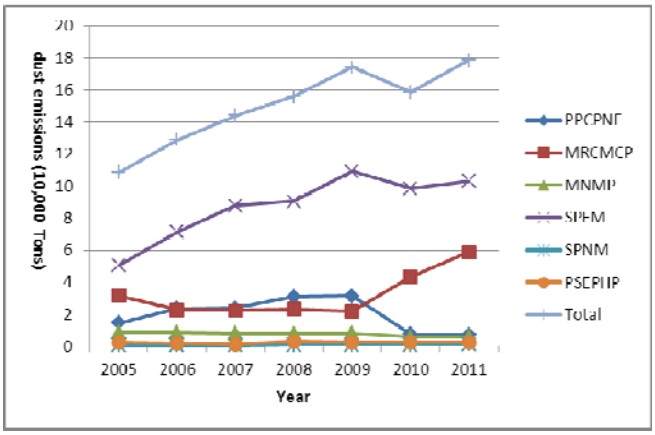

FIG.9 THE DUST EMISSIONS OF ENERGY INTENSIVE INDUSTRIES IN THE CITY OF TIANJIN

The SO_2 emissions, NOx emissions and dust emissions of Tianjin had also increased from 187,816.6, 177.085 and 108,317.6 tons in 2005 to 308,176.6, 290,893.1 and 178,317.3 tons in 2011, by

64.08%, 64.27% and 64.67% respectively. These upward trends are different from the trends in the city of Beijing. The most pollutant industry is the SPFM industry (FIG.7-FIG.9), whose emissions growth is 104.10%. The growth of the MRCMCP industry is also more obvious than the other industry. Among these industries, the pollutants emissions of the PPCPNF, MNMP and PSEPHP industry present downward trends.

He Bei Province

1) Energy Consumption

The energy consumption of the energy intensive industries in Hebei province also increased during the period of 2005 and 2011. In 2005, the energy intensive industries totally consumed 117.38 millions tons of tce, while in 2011, this number had researched to 171.93 million tons of tce, increasing by 46.47%. That was mainly contributed by the increase in energy consumption of SPFM industry (FIG.10), which had increased by 69.02% during this period. Besides, the energy consumption of the PSEPHP industry had also increased 46.27% during this period. Unlike the city of Beijing and Tianjin, all the energy consumption of the energy intensive industries in Hebei province show uptward trends.

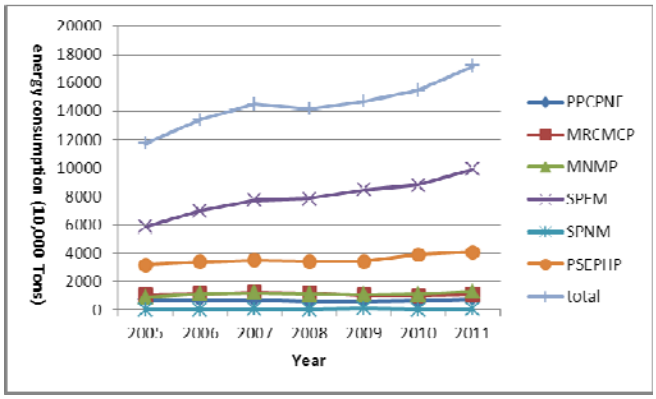

FIG.10 THE ENERGY CONSUMPTION OF ENERGY INTENSIVE INDUSTRIES IN HEBEI PROVINCE

2) Pollutants Emission

The SO_2 emissions, NOx emissions and dust emissions of Hebei province had also increased from 2.05, 1.88 and 1.09 million tons in 2005 to 2.98, 2.75 and 1.60 million tons in 2011, by 45.49%, 45.97% and 47.12% respectively. The most pollutant industry is the SPFM industry (FIG.11-FIG.13) too, whose emissions growth is 69.02%. There was no energy intensive industries of which the pollutant emissions had decreased during that period.

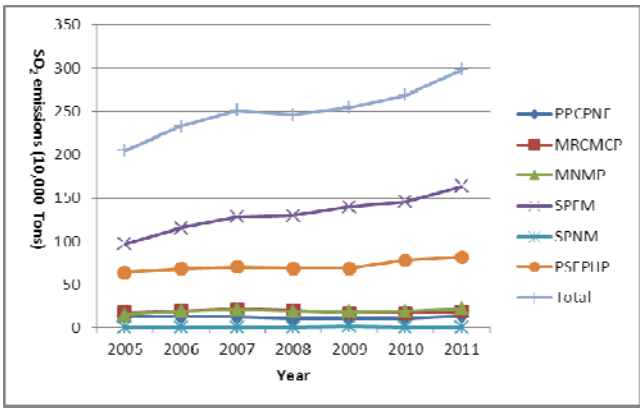

FIG.11 THE SO_2 EMISSIONS OF ENERGY INTENSIVE INDUSTRIES IN HEBEI PROVINCE

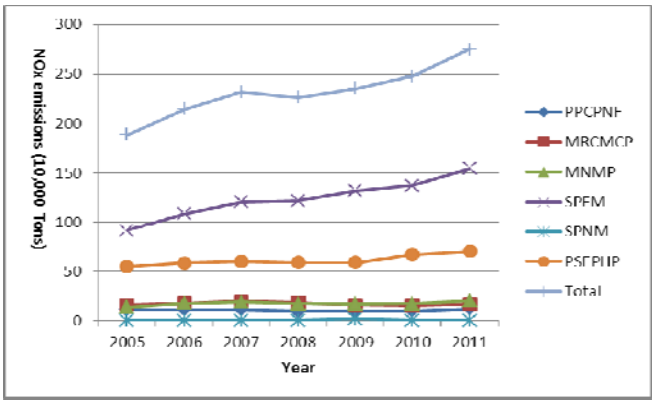

FIG.12 THE NQx EMISSIONS OF ENERGY INTENSIVE INDUSTRIES IN HEBEI PROVINCE

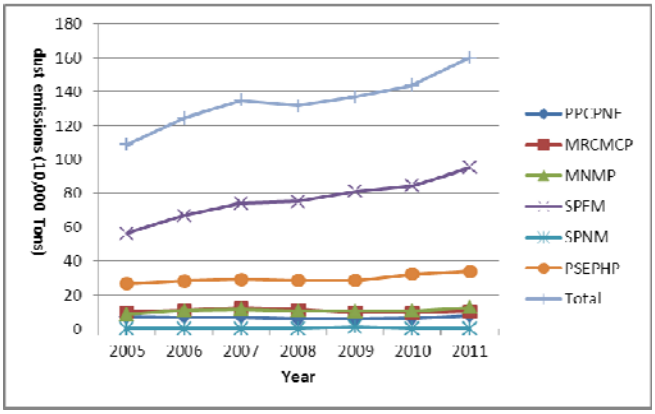

FIG.13 THE DUST EMISSIONS OF ENERGY INTENSIVE INDUSTRIES IN HEBEI PROVINCE

Conclusions

This work studys the energy consumption and pollutants emissions of energy intensive industries in the Beijing-Tianjin-Hebei region of China. It is found that the overall energy consumption and main pollutants emissions in this region increased during last few years with a large extent. Although the city of Beijing had made its great effort to reduce the energy consumption and pollutants emissions its own domain, and it also had made substainable achievements, the

works that the city of Tianjin and Hebei province made during last few years had made them so negligible that the overall air in this region is becoming more and more dirtier than before.

The results shows that air protection in Beijing-Tianjian-Hebei is not only the business of any single province, and they should cooperate for each other for getting their clearer air. Meantime, it can be clearly seen that the GDP contributions of the energy intensive industries across the three provinces are so unbalanced that as the development supporting part of Beijing, Hebei province should immediately adjust its industrial structure to be less energy consumption and pollutants emissions. And one of the main ways to realize this object is to regulate the fast development of its energy intensive industries. The role of the city of Tianjin in polluting the air in this region by expanding its energy intensive industries should not be negeleted since during last few years both the energy consumption and pollutant emissions by energy intensive industries growed fastest among the three provinces, the trend should be controlled.

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